NASA-USGS Post-Doctoral Fellow Opportunity Proposal 2018

Hyperspectral instruments and techniques to map strategic minerals

The Challenge: **[1-2 paragraphs describing the challenge, illustrating why it is national and/or global in scope.]**

Future satellite-based hyperspectral measurements will provide an opportunity to map exposures of strategic minerals across the globe, and perhaps off-world. The utility of such measurements has been demonstrated by a country-wide airborne campaign over Afghanistan. Scaling this approach to global coverages, or off-world, will require new tools. We will want to quantify:

- What spectral signatures co-vary with strategic minerals?
- How can we best deconvolve the data to identify and quantify strategic mineral signatures?
- What resolution is required to verify them?
- What observation gaps need to be filled to achieve global coverage?

These challenges are aligned with questions in the 2017 Decadal Survey (DS) "Thriving on Our Changing Planet: A Decadal Strategy for Earth Observation from Space", including: "How do we improve discovery and management of energy, mineral and soil resources as an Important goal to achieve." Specifically, "surface mineralogic composition and distribution" is a key Earth Science/Application Objective. The DS panel identified hyperspectral image data as a primary source to address this important science question.

The Opportunity: **[1-4 paragraphs that describe the research opportunity to address the challenge, with enough guidance that candidates can identify specific mapping, monitoring or modeling strategies to propose]**

This opportunity seeks a post-doctoral fellow who will work with the US Geological Survey (USGS), National Aeronautics and Space Administration (NASA), and industry in Silicon Valley to advance our ability to detect, quantify, and verify strategic minerals from orbital and airborne hyperspectral instruments. Proposals should address one or more of the four primary questions in the Challenge section. Proposals that leverage artificial intelligence (AI), machine learning techniques, existing pre-HyspIRI datasets, and/or the use of co-collected hyperspectral measurements from UAS are of particular interest. Competitive proposals will also address Surface Biology and Geology (SBG) Designated Observables and science questions related to Earth surface composition that are described in the NRC's 2017 Decadal Survey, "Thriving on our Changing Planet: A Decadal Strategy for Earth Observations from Space"(https://essp.nasa.gov/essp/files/2018/02/2017-Earth-Science-Decadal-Survey.pdf).

The fellow will work with Federal and industry partners to define the measurements needed, and to identify hyperspectral instruments that can be validated with ground-based field campaigns. They will be able to leverage USGS, NASA, and industry capabilities, including the USGS National spectral library for minerals, and a growing list of minerals whose use in critical technologies presents national security challenges. They

will have access to substantial, co-located NASA and USGS assets, including the NASA Earth Exchange (NEX), the USGS/NASA UAS Research Center, an ASD spectroradiometer, LI-COR quantum sensors, and Trimble sub-meter GPS and image processing software. The NEX platform provides access to high-performance computer resources co-located with ready to use massive data sets of multi-spectral, hyperspectral and lidar data sets and containerized workflows and other analytical tools.

Post-doctoral fellows will be located in Silicon Valley, one of the epicenters of global science and technology activity. Carnegie Mellon University's Silicon Valley campus will be across the street. The DoD Defense Innovation Unit is just a few blocks away. Stanford University, globally recognized science and technology companies, and many innovative new startups are within a few miles drive.

Proposed Duty Station: Moffett Field, California

Areas of Ph.D. Applicant: [Write the appropriate discipline expertise] *Geology, planetary geoscience, hydrology or related fields. Candidates holding a Ph.D. in other disciplines but with knowledge and skills relevant to the Research Opportunity may be considered.*

Qualifications: *Applicants must meet one of the following qualifications: Research Geophysicist; Research Geologist; Research Engineer. (This type of research is performed by those who have backgrounds for the occupations stated above. However, other titles may be applicable depending on the applicant's background, education, and research proposal. The final classification of the position will be made by the Human Resources specialist.)*

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